BOOK REVIEWS

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Spatial Pattern Analysis in Plant Ecology
Mark R.P. Dale. Cambridge University Press. New York. 326 pp.. paper. 3000. [ISBN 0-521-79437-4]

Recognizing pattern is something that humans excel at—even the youngest of children display remarkable capabilities. Translating this skill into mathematical and ecological sense, however, is a real challenge. Meaningful interpretation of spatial information. that is, the linking of pattern to process. is a difficulty that most ecological researchers face. In essence. it is often this task that defines our efforts. Because spatial pattern analysis is a relatively new and developing field, more guidance is needed before it will be widely implemented in science and management.

Spatial Pattern Analysis in Plant Ecology is an attempt to provide some theoretical and mathematical direction to this field. This treatise concentrates on the analysis portion of spatial pattern analysis, deferring most of the interpretation aspects to the researchers. Such deference is a virtual necessity, because while spatial pattern is the product of past process(es) and influences future dynamics, it may result from factors that range from simple to extremely varied or intricate. Furthermore, the driving forces that generate the observed pattern, regardless of scale, may change dramatically through time.

The first two chapters in this book focus on basic ecological fundamentals related to spatial pattern and pattern-sensitive sampling schemes. While these chapters are elementary, the points made are vital to the recognition and interpretation of spatial data. For example, in chapter 1 Dale emphasizes the importance of scale and hierarchy in the analysis of spatial data. Sample points that seem at one scale to be randomly dispersed can, at a larger scale, actually appear clustered. Other Features related to spatial pattern briefly reviewed in chapter I include patch size. spacing. density. legacies, shapes. age, history, and fractals.

Dale continues thr themes of scale and perspective in chapter 2, which focuses on sampling for spatial pattern. The first sentence of the opening paragraph of this chapter frames a critical step: before analysis should proceed. one must determine what is the question being asked and at which scale will it he answered. In most cases spatial pattern is not just an issue of clustering versus random versus regular distributions. but rather of understanding patterns arising at muttipte scales. Sampling designs for spatial pattern can differ notably from more traditional approaches. For example, autocorrelation may be an important. desirable facet of studying spatial pattern. While chapters 1 and 3 are not exhaustive accounts of spatial pattern and sampling. they highlight the features that are expressed throughout the rest of the book. Dale's penchant for analysis using presence, absence data and small quadrats becomes apparent even in these introductory chapters.

While just about any versed student of ecology can make good sense of chapters 1 and 2, the rest of this book delves into the mathematics of spatial pattern analysis and thus necessitates a higher level of analytical ability. In addition, Dale's approach to discussing spatial pattern analysis differs from that usually found in general ecology texts: he focuses less on the simple point-pattern analysis and concentrates on patterns found in transects. Chapter 3 considers the simplest case of this approach (one species and one dimension), using variance measures to detect patterns at different scales. Numerous designs to consider this are contrasted, resulting in an almost bewildering array of acronyms (e.g., BQV, TTLQV, 3TLQV, PQV, NLV). Chapter 4 adds further complexity to the mix by considering patterns of two species, while Chapter 5 moves on to multiple (> 2) species and Chapter 6 advances to patterns in two dimensions. As additional species and dimensions are gained. simple variance measures prove inadequate. The use of covariance addresses most of these problems, although the consideration of multiple species and dimensions adds geometrically to the complexity of the analysis.

Not until Chapter 7 does Dale address what many people think of when spatial analysis is mentioned: point patterns. Several methods commonly used to deduce or describe spatial point patterns (e.g.. Ripley 's K. tessellation. nearest neighbor) are critiqued, some rather unfavorably. Chapter 8 concentrates on patterns related to environmental gradients. Since the careers of many prominent ecologists have been devoted to the description of patterns related to environmental gradients. it may surprise some to see that Date has limited his discussion to a few dozen pages. But this is in keeping with the overall philosophy of this test. which is to introduce and review material briefly so as to frame the discussion for future exploration.

The final chapter chapter 9) summarizes the findings of this book and presents a set of directions intended to guide future research in this topic. A limited set of questions yet to be adequately addressed are provided, but these questions largely relate to the interpretation of spatial pattern rather than the development of further analytical techniques.

After reading *Spatial Pattern Analysis in Plant Ecology*, I felt that I knew considerably more about the field than when I started. Several of the chapters (especially 1, 2, and 8) had encapsulated valuable commentary on ecological analysis (whether spatial or not). For example, the role of scale in interpretation of data is an underappreciated factor biasing our results and their interpretation. Dale perhaps states it best in chapter 7 (p. 231): "it may not be appropriate to ask simply whether the kinds [of points] are segregated or aggregated, but rather we should ask at what scales are

they segregated and at what scales are they aggregated." The emphasis on quantifying spatial pattern using variance and covariance measures provides the reader with a set of tools capable of objectively identifying patterns, although this book provides little guidance to interpreting causation. In totality, this book was not an easy read because of the volume of complex equations, variables, acronyms, and jargon.

I also found the figures not as helpful as they should have been when illustrating the techniques of spatial pattern analysis. All too often, they lacked the detail and labels that would have facilitated understanding the material. One of the best figures t'or information content (Figure 4.9, p. 115) unfortunately had a minor error in the text, which could lead to some confusion. I was also disappointed that more effort to link this work to that occurring at larger scales was not made. The role of spatial pattern analysis in landscape ecology was introduced but not expanded upon, as the author stated his interest in small-scale plant ecology. I think this is more of an opportunity lost rather than a systematic flaw, and I hope it will be addressed in any future work.

I was also concerned that the extensive use of presence/absence data rather than more detailed abundance information may not do full justice to some natural patterns. While more tractable to analyze, presence/absence data can mask prominent features. For example, using the presence/absence data model, the same value (= 1) arises from cases when only one plant is presrnt in a quadrat, or if 50 or 500 plants are present. Obviously, quantity matters in understanding and interpreting many spatial patterns.

Dale's strong emphasis on the interaction between scale and spatial pattern is a refreshing perspective for quantitative plant ecology. Other vignettes of wisdom interspersed in the text, coupled with a consideration of the major mathematical approaches and a willingness to discuss the strengths and weaknesses of each technique added to the contributions of this effort. Although I would not recommend this book to novices, I believe *Spatial Pattern Analysis in Plant Ecology* would be a good addition to the libraries of advanced students and professionals.

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California

California Natural History Guides. John D. Stuart and John 0. Sawyer. University of California Press: Berkeley. 467 pp., paper. 200 1.

Trees and Shrubs of California **is** the sixty-second title in ths California Natural History Guides series. Amateurs, professionals and "other people who have an interest in California trees and shrubs" are the intended audience. The authors have made special effort to make the book "user friendly" using simple descriptions of botanical features i n the narrative descriptions and in thr dichotomous keys. This is certainly welcome for most users, although some purists may object. The field guide has attributes that would make it useful to people with an Interest in the diverse trees species of California.

Unique in field yuidss. the various California ecological regions are delineated on a state map and briefly described in the opening pages of the book. Throughout, each species section has the appropriate ecological region highlighted in which it can be found. Many regional or state field guides use a "dot" to indicate a species' presence for each county in a state to illustrate the range of a particular species. Eco-region maps create an ecological context for each California species. Short species narratives reinforce the ecological basis of this field guide. Most of the major native tree species can be found in thr volume, although the authors admit that only representative species of some shrub genera arc included. Some inv asiv e, non-nativ e species such as gorse, *Ulex europaea*, and Scotch broom, *Cytisu s scoparius*, are included in the field guide. Horticultural introductions are not included.

The botanical drawings are well executed. The photos are excellent to illustrate the form of the tree and landscapes in w hich a species can be found. Unfortunately, onlv 40 color plates are in the book. This serves only to wet the reader's appetite for more plates. it is unfortunate that this field guide cannot have plates for most of the species. Beautiful color photos and illustrations make our reading more pleasurable; indeed, photos make it easier to thumb through the pages and exclaim "That's it!" w hen we find a species that we do not recognize.

Trees and Shrubs of California suffers like all field guides from the format we expect from field guides. We expect and receive great detail about the individual species in the narratives and the drawings. There is a checklist to gauge our success in tree "spotting." The smphasis of all field guides is on the identification of a specimen to tit into our "drawers" of collecting snd classification. Perhaps in today's computer-driven parlance, we use "folders" to sort such information. Either way, this is an excellent Addition to any tree or plant lover's library.

What most field guides fail to do is to place specimens we identify in the field into an ecological context. Field guides are often what people First grab when they go to a library or bookstore to learn more about the outside world. This contextual oversight is not so crucial for the professional audience since they should have some training in ecological principles. However, the general public and young students are short-changed from the wonderful complexity of ecology and species interaction. Field guides provide an excellent opportunity to educate, but are far too often strictly limited to species identification by our own expectations.

From the lack of a more complete set of color plates, economics clearly limits w hat the authors of the *Trees and Shrubs of California* can achieve. How many people w ill pay tw ice or three times more for a field guide that includes color photos for each species? Will people pay four or five